

## Bruce Gordon Bills

Planetary Science Section  
Jet Propulsion Laboratory  
Pasadena, CA 91109

### Education

Ph.D. (1978) California Institute of Technology  
Planetary Science / Geophysics

B.S. (1973) Brigham Young University  
Mathematics / Physics

### Appointments

Jet Propulsion Laboratory, Pasadena, California  
2008-present

Scripps Institution of Oceanography, La Jolla, California  
1998-present Visiting Research Geophysicist

Goddard Space Flight Center, Greenbelt, Maryland  
1990-2008 Geophysicist  
Geodynamics Branch

Johns Hopkins University, Baltimore, Maryland  
1991-1998 Adjunct Professor  
Department of Earth and Planetary Sciences

Lunar and Planetary Institute, Houston, Texas  
1984-1990 Staff Scientist

Jet Propulsion Laboratory, Pasadena, California  
1983-1984 Senior Scientist  
Planetary Radar Group  
Earth and Space Sciences Division  
1979-1983 Senior Scientist  
Planetary Dynamics and Geophysics Group  
Earth and Space Sciences Division  
1977-1979 Senior Engineer  
Tracking and Orbit Determination Group  
Systems Division

### Professional Society Memberships

American Geophysical Union (since 1973)  
Geological Society of America (since 1987)  
American Quaternary Association (since 1988)

## Publications

1. McNamara, D.H., and **B.G. Bills** (1973),  
Photometric and spectrographic observations of HR6684,  
*Pub. Astron. Soc. Pac.*, 85, 632-636. research article
2. **Bills, B.G.**, and A.J. Ferrari (1977),  
A harmonic analysis of lunar topography,  
*Icarus*, 31, 244-259. research article
3. **Bills, B.G.**, and A.J. Ferrari (1977),  
A lunar density model consistent with topographic,  
gravitational, librational and seismic data,  
*J. Geophys. Res.*, 82, 1306-1314. research article
4. **Bills, B.G.**, and A.J. Ferrari (1978),  
Mars topography harmonics and geophysical implications,  
*J. Geophys. Res.*, 83, 3497-3508. research article
5. Ferrari, A.J., and **B.G. Bills** (1979),  
Planetary geodesy,  
*Rev. Geophys. Space Phys.*, 17, 1663-1677. research article
6. **Bills, B.G.**, and A.J. Ferrari (1980),  
A harmonic analysis of lunar gravity,  
*J. Geophys. Res.*, 85, 1013-1025. research article
7. Ananda, M.P., W.L. Sjogren, R.J. Phillips, and **B.G. Bills** (1980),  
A low-order global gravity field of Venus and  
dynamical implications,  
*J. Geophys. Res.*, 85, 8303-8318. research article
8. Esposito, P.B., W.L. Sjogren, N.A. Mottinger, **B.G. Bills**, and E. Abbott (1982),  
Venus gravity: Analysis of Beta Regio,  
*Icarus*, 51, 448-459. research article
9. **Bills, B.G.** (1983),  
Thermoelastic bending of the lithosphere,  
*Geophys. J. Roy. Astr. Soc.*, 75, 169-200. research article
10. Sjogren, W.L., **B.G. Bills**, P.W. Birkeland, P.W. Esposito,  
A.R. Konopliv, N.A. Mottinger, S.J. Ritke, and R.J. Phillips (1983),  
Venus gravity anomalies and their correlation with topography,  
*J. Geophys. Res.*, 88, 1119-1128. research article
11. Reasenberg, R.D., and **B.G. Bills** (1983),  
Critique of "Elastic thickness of the Venus lithosphere  
estimated from topography and gravity",  
*Geophys. Res. Lett.*, 10, 93-96. research article
12. Sjogren, W.L., **B.G. Bills**, and N.A. Mottinger (1984),  
Venus: Ishtar gravity anomaly,  
*Geophys. Res. Lett.*, 11, 489-491. research article
13. **Bills, B.G.**, and M. Kobrick (1985),  
Venus topography: A harmonic analysis,  
*J. Geophys. Res.*, 90, 827-836. research article

14. Mottinger, N.A., W.L. Sjogren, and **B.G. Bills** (1985),  
 Venus gravity: A harmonic analysis and  
 geophysical implications,  
*J. Geophys. Res.*, 90, C739-C756. research article
15. Kiefer, W.S., M.A. Richards, B.H. Hager, and **B.G. Bills** (1986),  
 A dynamic model of Venus's gravity field,  
*Geophys. Res. Lett.*, 13, 14-17. research article
16. Nakamura, Y., J. Oberst, S.M. Clifford, and **B.G. Bills** (1986),  
 Comments on the letter "On the influx of small comets  
 into the Earth's upper atmosphere",  
*Geophys. Res. Lett.*, 13, 1184-1185. research article
17. **Bills, B.G.**, and S.P. Synnott (1987),  
 Planetary geodesy,  
*Rev. Geophys.*, 25, 833-839. research article
18. **Bills, B.G.**, W.S. Kiefer, and R.L. Jones (1987),  
 Venus gravity: A harmonic analysis,  
*J. Geophys. Res.*, 92, 10,335-10,351. research article
19. **Bills, B.G.**, and G.M. May (1987),  
 Lake Bonneville: Constraints on lithospheric thickness and  
 upper mantle viscosity from isostatic warping of shorelines,  
*J. Geophys. Res.*, 92, 11,493-11,508. research article
20. Herrick, R.R., **B.G. Bills**, and S.A. Hall (1989),  
 Variations in effective compensation depth across  
 Aphrodite Terra, Venus,  
*Geophys. Res. Lett.*, 16, 543-546. research article
21. **Bills, B.G.** (1989),  
 The moments of inertia of Mars,  
*Geophys. Res. Lett.*, 16, 385-388. research article
22. **Bills, B.G.** (1989),  
 Planetary geodesy,  
 in *The Encyclopedia of Solid Earth Geophysics*,  
 edited by D.E. James,  
 Van Nostrand Reinhold, pp. 931-938. research article
23. **Bills, B.G.** (1989),  
 Comment on "More about the moment of inertia of Mars",  
*Geophys. Res. Lett.*, 11, 1337-1338. research article
24. **Bills, B.G.** (1990),  
 Geodetic constraints on the composition of Mars,  
*J. Geophys. Res.*, 95, 14,131-14,136. research article
25. **Bills, B.G.** (1990),  
 The rigid body obliquity history of Mars,  
*J. Geophys. Res.*, 95, 14,137-14,153. research article

26. May, G.M., **B.G. Bills**, and D.S. Hodge (1991),  
 Far-field flexural response of Lake Bonneville from  
 paleopluvial lake elevations,  
*Phys. Earth Planet. Inter.*, 68, 274-284. research article
27. **Bills, B.G.** (1992),  
 Venus: Satellite orbital decay, ephemeral ring formation,  
 and subsequent crater production,  
*Geophys. Res. Lett.*, 19, 1025-1028. research article
28. Dixon, T.H., and **B.G. Bills** (1992),  
 What is DOSE?  
*Eos Trans. Amer. Geophys. Union*, 73, 276-277. research article
29. Esposito, P.B., W.B. Banerdt, G.F. Lindal, W.L. Sjogren, M.A. Slade,  
**B.G. Bills**, D.E. Smith, and G. Balmino,  
 Gravity and topography,  
 in *Mars*, edited by H.H. Kiefer, B.M. Jakosky,  
 C.W. Snyder and M.S. Mathews,  
 University of Arizona Press, pp. 209-248. book chapter
30. **Bills, B.G.**, and M.A. Fischer (1992),  
 A spatial domain Stokes flow model for the gravity and  
 topography of the middle latitudes of Venus,  
*J. Geophys. Res.*, 97, 18,285-18,294. research article
31. **Bills, B.G.** (1993),  
 Geodynamic contributions to global climatic change,  
 in *Orbital, Rotational and Climatic Interactions*,  
 NASA Conf. Publ. 3815, pp. 1-33. conference proceeding
32. Nerem, R.S., **B.G. Bills**, and J.B. McNamee (1993),  
 A high resolution gravity model for Venus: GVM-1,  
*Geophys. Res. Lett.*, 20, 599-602. research article
33. **Bills, B.G.** (1994)  
 Obliquity-oblateness feedback: Are climatically sensitive values of  
 obliquity dynamically unstable?  
*Geophys. Res. Lett.*, 21, 177-180. research article
34. **Bills, B.G.**, S.L. de Silva, D.R. Currey, R.S. Emenger, K. Lillquist,  
 A. Donnellan, and B. Worden (1994),  
 Hydro-isostatic deflection and tectonic tilting in the Central Andes:  
 Initial results of a GPS survey of Lake Minchin shorelines,  
*Geophys. Res. Lett.*, 21, 293-296. research article
35. **Bills, B.G.**, D.R. Currey, and G.A. Marshall (1994),  
 Viscosity estimates for the crust and upper mantle from patterns  
 of lacustrine shoreline deformation in the eastern Great Basin,  
*J. Geophys. Res.*, 99, 22,059-22,086. research article
36. **Bills, B.G.**, and R.R. Nerem (1995),  
 A harmonic analysis of Martian topography,  
*J. Geophys. Res.* 100, 26,317-26,326. research article

37. **Bills, B.G.**, and D.P. Rubincam (1995),  
 Constraints on density models from radial moments:  
 Application to the Earth, Moon and Mars,  
*J. Geophys. Res.* 100, 26,305-26,315. research article
38. **Bills, B.G.** (1995)  
 Discrepant estimates of the moments  
 of inertia of the Moon  
*J. Geophys. Res.* 100, 26,297-26,303. research article
39. **Bills, B.G.**, and F.G. Lemoine (1995),  
 Gravitational and topographic isotropy of  
 the Earth, Moon, Mars and Venus,  
*J. Geophys. Res.* 100, 26,275-26,295 research article
40. Kiefer, W.S., **B.G. Bills**, and R.S. Nerem (1996),  
 An inversion of gravity and topography for mantle and  
 crustal structure on Mars,  
*J. Geophys. Res.* 101, 9239-9252. research article
41. Frey, H.V., **B.G. Bills**, R.S. Nerem, and J.H. Roark (1996),  
 The isostatic state of Martian topography revisited,  
*Geophys. Res. Lett.* 23, 721-724. research article
42. **Bills, B.G.**, and T.S. James (1996),  
 Late Quaternary variations in relative sea level  
 due to glacial cycle polar wander,  
*Geophys. Res. Lett.* 23, 3023-3026. research article
43. Shirron, P.J., M.J DiPirro, S.H. Castles, **B.G. Bills**, H.J Paik,  
 E.R. Canavan and M.V. Moody (1996),  
 Mission concepts for the Superconducting  
 Gravity Gradiometer,  
*Cryogenics*, 36, 805-813. research article
44. Folkner, W.M., R.D. Kahn, R.A. Preston, C.F. Yoder, C.D. Edwards,  
 R. Hellings, E. M. Standish, M. Eubanks, and **B.G. Bills** (1997),  
 Mars dynamics from Earth-based tracking of  
 the Mars Pathfinder Lander,  
*J. Geophys. Res.* 102, 4057-4064. research article
45. **Bills, B.G.**, and T.S. James (1997),  
 Polar motion of a viscoelastic Earth due to glacial cycle mass loading,  
*J. Geophys. Res.* 102, 7579-7602. research article
46. Tackman, G.E., D.R. Currey, **B.G. Bills**, and T.S. James (1998),  
 Paleoshoreline evidence for postglacial tilting in Southern Manitoba,  
*J. Paleolimnology*, 19, 343-363. research article
47. **Bills, B.G.**, and T.S. James (1999),  
 Moments of inertia and rotational stability of Mars:  
 Lithospheric support of sub-hydrostatic rotational flattening,,  
*J. Geophys. Res.* 104, 9081-9096. research article

48. **Bills, B.G.** (1999),  
 Tidal despinning of the mantle, inner core super-rotation,  
 and outer core effective viscosity  
*J. Geophys. Res.* 104, 2653-2666. research article
49. **Bills, B.G.**, J.G. Mengel, and T.S. James (1999),  
 Climatic impact of glacial cycle polar motion:  
 Coupled oscillations of ice sheet mass and rotation pole position,  
*J. Geophys. Res.*, 104, 1059-1075. research article
50. Tackman, G.E., **B.G. Bills**, T.S. James, and D.R. Currey (1999),  
 Lake gauge evidence for regional postglacial tilting in Southern Manitoba  
*Geol. Soc. Amer. Bull.* 111, 1684-1699. research article
51. Adams, K.D., S.G. Wesnousky, and **B.G. Bills** (1999),  
 Isostatic rebound, active faulting, and potential geomorphic effects  
 in the Lake Lahontan Basin, Nevada and California  
*Geol. Soc. Amer. Bull.* 111, 1739-1756. research article
52. Ray, R.D., **B.G. Bills**, and B.F. Chao (1999),  
 Lunar and solar torques on the oceanic tides,  
*J. Geophys. Res.* 104, 17,653-17,659. research article
53. **Bills, B.G.** (1999),  
 Obliquity-oblateness feedback on Mars,  
*J. Geophys. Res.* 104, 30,773-30,798. research article
54. **Bills, B.G.**, and R.D. Ray (1999),  
 Lunar orbital evolution: Synthesis of recent results,  
*Geophys. Res. Lett.* 26, 3045-3048. research article
55. Clifford, S.M., D. Crisp, D. Fisher, D. Crisp, D.A. Fisher, K.E. Herkenhoff, S.E. Smrekar,  
 P.C. Thomas, D.D. Wynn-Williams, R.W. Zurek, J.R. Barnes, **B.G. Bills**, E.W. Blake,  
 W.M. Calvin, J.M. Cameron, M.H. Carr, P.R. Christensen, B.C. Clark, G.D. Clow, J.A.  
 Cutts, D. Dahl-Jensen, W.B. Durham, F.P. Fanale, J.D. Farmer, F. Forget, K. Gotto-  
 Azuma, R. Grard, R.M. Haberle, W. Harrison, R. Harvey, A.D. Howard, A.P. Ingersoll,  
 P.B. James, J.S. Kargel, H.H. Kieffer, J. Larsen, K. Lepper, M.C. Malin, D.J. McCleese,  
 B. Murray, J.F. Nye, D.A. Paige, S.R. Platt, J.J. Plaut, N. Reeh, J.W. Rice, D.E. Smith,  
 C.R. Stoker, K.L. Tanaka, E. Mosley-Thompson, T. Thorsteinsson, S.E. Wood, A. Zent,  
 M.T. Zuber, and H.J. Zwally (2000),  
 The state and future of Mars polar science and exploration,  
*Icarus*, 144, 210-242. research article
56. **Bills, B.G.**, and R.D. Ray (2000),  
 Galilean satellite obliquities,  
*J. Geophys. Res.*, 105, 29,277-29,282. research article
57. **Bills, B.G.**, and R.S. Nerem (2001),  
 Mars topography: Lessons learned from spatial and spectral  
 domain comparisons of Mars Orbiter Laser Altimeter and  
 U.S. Geological Survey data,  
*J. Geophys. Res.*, 106, 32,915-32,925. research article
58. **Bills, B.G.**, T.J. Wambeam, and D.R. Currey (2002)  
 Geodynamics of Lake Bonneville,  
 in *Great Salt Lake: An overview of change*,  
 ed. J. Wallace Gwynn, Utah Geol. Survey, pp. 7-32. book chapter

59. Comstock, R.L., and **B.G. Bills** (2003),  
 A solar system survey of forced librations in longitude,  
*J. Geophys. Res. Planets*, 108, 5100. research article
60. Egbert, G.D., R.D. Ray, and **B.G. Bills** (2004),  
 Numerical modeling of the global semidiurnal tide in  
 the present day and in the last glacial maximum,  
*J. Geophys. Res. Oceans*, 109, C03003. research article
61. **B.G. Bills** (2005),  
 Free and forced obliquities of the Galilean satellites of Jupiter,  
*Icarus*, 175, 233-247. research article
62. **B.G. Bills**, and R.L. Comstock (2005),  
 Spatial and temporal patterns of solar eclipses by Phobos on Mars,  
*J. Geophys. Res. Planets*, 110, E04004. research article
63. **B.G. Bills**, and R.L. Comstock (2005),  
 Forced obliquity variations of Mercury,  
*J. Geophys. Res. Planets*, 110, E04006. research article
64. **Bills, B.G.**, G.A. Neumann, D.E. Smith, and M.T. Zuber (2005),  
 Improved estimate of tidal dissipation within Mars from  
 MOLA observations of the shadow of Phobos,  
*J. Geophys. Res. Planets*, 110, E07004. research article
65. Munk, W.H., and **B.G. Bills** (2007),  
 Tides and the climate: some speculations,  
*J. Phys. Ocean.* 37, 135-147 . research article
66. Fricker, H.A., A.A. Borsa, J.B. Minster, C. Carabajal, K. Quinn, and **B.G. Bills** (2005),  
 Assessment of ICESat performance at the salar de Uyuni, Bolivia  
*Geophys. Res. Lett.* 32, L21S06. research article
67. **Bills, B.G.**, (2005),  
 Variations in the rotation rate of Venus due to orbital  
 eccentricity modulation of solar tidal torques,  
*J. Geophys. Res. Planets*, 110, E11007. research article
68. **Bills, B.G.**, K.D. Adams, and S.G. Wesnousky (2007),  
 Viscosity structure of the crust and upper mantle in western  
 Nevada from isostatic rebound patterns of Lake Lahontan shorelines,  
*J. Geophys. Res.*, 112, B06405.. research article
69. **Bills, B.G.**, A.A. Borsa, and R.L. Comstock (2007),  
 MISR-based passive optical bathymetry from orbit with cm-level  
 accuracy on the salar de Uyuni, Bolivia  
*Remote. Sens. Environ.*, 107, 240-255. research article
70. Borsa, A.A., J-B Minster, **B.G. Bills**, and H A. Fricker (2007),  
 Modeling long-period noise in kinematic GPS applications,  
*J. Geodesy*, 81, 157-170. research article
71. Borsa, A., H.A. Fricker, **B.G. Bills**, J-B, Minster, C. Carabajal, and K. Quinn (2008),  
 Topography of the salar de Uyuni, Bolivia from kinematic GPS,  
*Geophys. J. Int.*., 172, 31-40. research article

72. Luttrell, K., D Sandwell, B. Smith-Konter, **B.G. Bills**, and Y. Bock (2007),  
 Modulation of the earthquake cycle at the southern San Andreas fault by lake loading  
*J. Geophys. Res.*, 112, B08411. research article
73. Bulow, R.C., C.L. Johnson, **B.G. Bills**, and P.M. Shearer (2007),  
 Temporal and spatial properties of some deep Moonquake clusters,  
*J. Geophys. Res.*, 112, E09003. research article
74. Hurford, T.A., P. Helfenstein, G.V. Hoppa, R. Greenberg, and, **B.G. Bills** (2007),  
 Eruptions arising from tidally controlled periodic openings of rifts on Enceladus,  
*Nature*, 447, 292-294. research article
75. **B.G. Bills**, and F. Nimmo (2008),  
 Forced obliquity and moments of inertia of Titan,  
*Icarus*, 196, 293-297. research article
76. Borsa, A.A., **B.G. Bills**, and J.B. Minster (2008)  
 Modeling the topography of the salar de Uyuni, Bolivia, as an  
 equipotential surface of Earth's gravity field,  
*J. Geophys. Res.*, B10408. research article
77. **B.G. Bills** (2009),  
 Tidal flows in satellite oceans,  
*Nature Geoscience*, 2, 13-14 research article
78. Hurford, T.A., A.R. Sarid, R. Greenberg, and **B.G. Bills** (2009)  
 The influence of obliquity on Europan cycloid formation,  
*Icarus*, in press, research article
79. Hurford, T.A., **B.G. Bills**, P. Helfenstein, R. Greenberg, G.V. Hoppa,  
 and D.P. Hamilton (2009),  
 Geological implications of a physical libration on Enceladus,  
*Icarus*, in press research article
80. **Bills, B.G.**, F. Nimmo, O. Karatekin, T. Van Hoolst, N. Rambaux,  
 B. Levrard, and J. Laskar (2009)  
 Rotational dynamics of Europa, in *Europa*, eds. R. Pappalardo, W. McKinnon,  
 and K. Khurana, Univ. Arizona Press. book chapter
81. Weber, R.C., **B.G. Bills**, and C.L. Johnson, (2009),  
 Constraints on deep moonquake focal mechanisms through analysis of tidal stress,  
*J. Geophys. Res.*, in press research article